REMARKS

The same reference number 46 was used for the sub-collector in FIGS. 10 and 11, and for the dashed curve in FIG. 12. To eliminate this duplication, the dashed curve in FIG. 12 has been renumbered 47; a replacement sheet for FIG. 12 is enclosed.

Claims 1 and 4-5 were rejected under 35 USC 102(a) as anticipated by Blayac et al. (US 2001/0015474), while claims 2-3, 9-11 and 13-14 were rejected under 35 USC 103(a) over Blayac et al. in view of Gutierrez-Aitken et al. (US 6,376,867), claims 6, 8, 15 and 17 were rejected under 35 USC 103(a) over Blayac et al. in view of Katoh (US 5,041,882), and claim 12 was rejected under 35 USC 103(a) over Blayac et al. in view of Gutierrez-Aitken et al. and further in view of Katoh. The Blayac et al. reference is common to each of these rejections, and it will be the primary focus of discussion.

Blayac et al. discloses in FIGS. 7a-7d a heterojunction bipolar transistor (HBT) structure with two sub-collectors: an upper InGaAs sub-collector SC, and a lower InP sub-collector SC'. The upper sub-collector SC is used in the formation of a bridge structure; the SC is laterally etched to form the bridge (see paragraphs 0067 and 0068). The thickness of the SC layer in Blayac et al. is dictated by the desired bridge dimensions, whereas in the present invention the purpose of the InGaAs contact layer (which the Office action equates to Blayac et al. layer SC) is to both serve as an electrical contact layer, and to provide a thermal conduction path between the collector and sub-collectors on opposite sides of it. In Blayac et al. the only indication as to the thickness of the SC layer is that it is shown in the figures as being of comparable thickness to the SC' sub-

collector layer. By contrast, applicants' contact layer 8 is thin enough "so that it permits a high degree of thermal conduction from the collector to the sub-collector, thereby allowing for higher power dissipation from the device" (specification page 2, line 30-page 3, line 5).

The purpose of applicant' InGaAs contact layer is to provide a better contact to the InP sub-collector, while still allowing for adequate thermal transfer out of the device. Applicants recognize that "it is difficult to establish a low resistance contact from a metal to the InP sub-collector of a DHBT" (page 2, lines 16-18), and add the InGaAs contact layer to facilitate a lower resistance contact to the sub-collector. Since InGaAs is not as good a thermal conductor as InP, the contact layer is deliberately made sufficiently thin to allow for a good thermal transfer from the collector 6 to the sub-collector 4, "thereby allowing dissipated power (heat) to be removed from the device by a vertical thermal transfer to the high thermal conductivity InP sub-collector and substrate." (page 4, line 30-page 5, line 5).

There is no suggestion in Blayac et al. that the upper sub-collector SC be made thin enough to enable a vertical heat transfer. In fact, since layer SC is mostly etched away in the fabrication of the bridge structure (see FIG. 7d), its thermal transfer capabilities would not be an issue. Rather, its thickness is dictated by the desired bridge dimensions. The InGaAs sub-layer SC is described by Blayac et al. as being "very conductive and makes it possible to collect the charges" (paragraph 0062). Applicants' InGaAs contact layer is deliberately made thin enough that it can <u>not</u> function as a sub-collector by itself, because it

is "too thin to be adequately conductive in the horizontal plane".

This distinction has been emphasized by amending claim 1 to describe the contact layer as "being thin enough to have a lateral conductivity inadequate for it to function by itself as a contact to the collector layer, but functioning as an electrical conductor between said collector and sub-collector layers".

Independent claim 9, along with various dependent claims, was rejected over the combination of Blayac et al. and Gutierrez-Aitken et al., the Office action concluding that it would have been obvious to select the thickness of the first Gutierrez-Aitken et al. sub-collector layer in the range of 100-200 Angstroms in Blayac's device, since it allows for a good thermal transfer from the collector to the sub-collector, hence preventing overheating. But this is contrary to the purpose of the SC layer/SC' structure of Blayac et al., in which the SC layer is both "very conductive and makes it possible to collect the charges", and acts as a structural feature in the fabrication of the bridge. Both of these purposes would be negated by making the SC layer so thin as to "have a lateral conductivity inadequate for it to function by itself as a contact to the collector", as required by the present amendment to claim 9. Accordingly, not only is there no suggestion in either reference that the two should be combined in this way, doing so would be contrary to the basic purposes of the SC layer in Blayac et al.

The other claim rejections involving Blayac et al. are all of claims that depend from either independent claims 1 or 9. Since these independent claims should be allowable, their dependent claims should likewise be allowable.

With respect to the rejection of claims 18-20 under 35 USC 102(b) as anticipated by Katoh, the embodiment of applicants' invention illustrated in FIG. 11 has the transistor emitter, base and collector (respectively identified by reference numbers 12-16, 10 and 6 in FIG. 9) laterally surrounded by air gaps that would provide electrical isolation from other devices on the same substrate. The only element of the transistor which has an electrically insulative portion electrically isolating the HBT is the sub-collector 46. This contrasts with Katoh, which is a planar device from the base down and includes an insulating ring 13 that provides a common lateral isolation for the base, the collector and the sub-collector.

As noted at page 8, lines 22-25 of the present application, "a portion of the sub-collector 4 surrounding the remainder of the DHBT would also normally be etched away as shown in FIG. 9, to provide electrical isolation for the device". This would be the natural tendency for a device with a mesa-like structure in which lateral isolation is provided by an air gap. By contrast, in Katoh there is already an insulative implant surrounding the base and collector, and the natural tendency would be to simply extend it through the sub-collector as Katoh has done. This would <u>not</u> have been an obvious thing to do for a device such as applicants', which has no other insulating region laterally surrounding any other portion of the HBT.

Claim 18 has been amended to require that the emitter, base and collector layers of the HBT be surrounded laterally by air gaps for lateral isolation, and further that the electrically insulated portion of the sub-collector layer "laterally surrounds" and electrically isolates the HBT. This is believed to make

claim 18 allowable, which should also overcome the 35 USC 103(a) rejection of claim 21 over Katoh in view of Lammert (US 6,406,965).

Claims 7 and 16 were objected to as being dependent upon a rejected base claim, but were found to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 7 and 16 have been rewritten accordingly. Claims 22-32 are the subject of a divisional application, and have accordingly been cancelled.

The above arguments with respect to Blayac et al. are presented on the assumption that Blayac et al. may be prior art. However, to the best of applicants' knowledge, their invention was made prior to any prior art date that can legitimately be ascribed to Blayac et al. The patent was cited as prior art under 35 USC 102(a): "the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent".

Blayac et al. was filed in the U.S. on February 13, 2001, claiming the priority of a French application that was filed on February 14, 2000. Since the French application was not "in this country", and French applications are not published until 18 months after their filing, the effective date of Blayac et al. for purposes of 35 USC 102(a) is its February 13, 2001 U.S. filing date.

The accompanying Declaration of co-applicant Richard L. Pierson, Jr. establishes an invention date not later than February 7, 2001 for the present invention, preceding the effective date of Blayac et al. Although no independent documentation of applicants' original conception date has been located, as stated in the

Pierson declaration by February 7, 2001 the invention had been conceived. This is evidenced by orders placed on that date with two vendors for wafers from which samples embodying the invention could be fabricated. The wafers from one of the vendors were shipped on February 28, 2001, and from the other vendor on March 29, 2001. Upon receipt of the wafers, Mr. Pierson promptly requested scheduling at the earliest available date by the fabrication unit at his employer Rockwell Science Center (presently Rockwell Scientific Company), so that the wafers could be processed into finished parts by etching contact areas and adding contacts and metallization. Work was performed on the processing on a regular basis, with gaps of no more than a few working days between documented process activities (in addition to processing for which dates were not documented) from the first available fabrication date of April 19, 2001 to the completion of samples on June 7, 2001. The samples were promptly and successfully tested, with the testing completed on or about June 11, 2001. The devices were shown to be operable for their intended purpose as heterojunction bipolar transistors.

Since the invention was conceived prior to the effective prior art date of Blayac et al., followed by diligence from a date prior to Blayac et al. in reducing the invention to practice, Blayac et al. is not prior art to the present application. The only significant gaps in active work on the reduction to practice from February 7, 2001 onwards were the February 7 - March 29, 2001 period while applicants were awaiting the arrival of the wafers from which the samples would be fabricated, and the March 29 - April 19, 2001 period while applicants were waiting for the Rockwell Science Center fabrication facility to become available. These gaps were not lengthy, and in

fact the February 7 - March 29 period was not a gap at all, since the vendors were working on the substrates during this time. Once the Rockwell fabrication facilities became available, active work towards the reduction to practice promptly resumed.

The original claims that were rejected over Blayac et al. (1-6, 8-15 and 17) have accordingly been re-presented in their original form as claims 33-47. Claims 1 and 9 have been retained and amended to distinguish over Blayac et al., in case the subject matter of this reference should turn out to be prior art to the present invention through some mechanism presently unknown to applicants.

Since all of the claims should now be in proper form for allowance, a Notice of Allowance is respectfully requested.

Respectfully submitted,

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